Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations	)	IB Docket No. 18-315

COMMENTS OF SES AMERICOM, INC. AND O3B LIMITED

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SES Americom, Inc. and its affiliate, O3b Limited, (collectively, "SES") hereby submit these comments regarding the above-referenced Notice of Proposed Rulemaking proposing to adopt regulations to govern the operations of Earth Stations in Motion ("ESIMs") with non-geostationary orbit ("NGSO") satellites in the fixed-satellite service ("FSS").[1] SES strongly agrees with the Commission that laying the groundwork for ESIMs to communicate with NGSO constellations will "promote innovative and flexible use of satellite technology" and foster regulatory parity between geostationary orbit ("GSO") satellites and NGSO systems.[2]

I. INTRODUCTION AND SUMMARY

SES, one of the world's largest commercial communications satellite operators, is the only company that operates both GSO and NGSO satellite fleets. SES entities operate more than 50 GSO satellites able to reach 99% of the world's population, many of them pursuant to Commission authority. These spacecraft serve broadcasters, direct-to-home ("DTH") service providers, and corporate and government customers worldwide with offerings that include video and audio content distribution, DTH, private networks, broadband, satellite news gathering, aeronautical and maritime services, and mobile backhaul.

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[1] *Facilitating the Communications of Earth Stations in Motion with Non-Geostationary Orbit Space Stations*, Notice of Proposed Rulemaking, FCC 18-160, IB Docket No. 18-135 (rel. Nov. 16, 2018) ("NPRM").
[2] *Id.* at ¶ 1.

The SES fleet includes the O3b Medium-Earth-Orbit ("MEO") NGSO system, which provides high-throughput, low-latency connectivity for enterprise, government, and mobility clients. The O3b system combines satellite reach with fiber optic speed, delivering the performance of terrestrial networks in places those networks do not reach, and making affordable broadband connectivity accessible for billions of consumers and businesses in nearly 180 countries. SES currently operates sixteen MEO satellites, and in 2018 was granted expanded Commission authority to serve the U.S. using additional spectrum and employing new satellites both for its current O3b system and its planned O3b mPOWER MEO constellation.[3]

The Commission recently expanded its ESIMs rules for GSO satellites to authorize operations in Ka-band frequencies.[4] SES supported those changes and urged the Commission to address NGSO ESIMs as well, noting that they are fully compatible with GSO satellite operations, including GSO ESIMs.[5] Other parties agreed that the Commission should explore rules for NGSO ESIMs,[6] and no commenter raised specific concerns regarding SES's proposals. The Commission acknowledged this record support for NGSO ESIMs rules but deferred

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[3] *O3b Limited*, Order and Declaratory Ruling, 33 FCC Rcd 5508 (2018) ("O3b Market Access Modification Grant").

[4] *Amendment of Parts 2 and 25 of the Commission's Rules to Facilitate the Use of Earth Stations in Motion Communicating with Geostationary Orbit Space Stations in Frequency Bands Allocated to the Fixed-Satellite Service*, Report and Order and Further Notice of Proposed Rulemaking, FCC 18-138 ("GSO ESIMs Order") (rel. Sept. 27, 2018).

[5] *See* Comments of SES Americom, Inc. and O3b Limited, IB Docket No. 17-95 (filed July 31, 2017); Reply Comments of SES Americom, Inc. and O3b Limited, IB Docket No. 17- 95 (filed Aug. 30, 2017). *See also* ORBIT, "Ocean TRx 7 Maritime Stabilized VSAT System," http://orbit-cs-usa.com/?product=oceantrx-7 (describing a dual GSO/NGSO-capable antenna available for commercial use) and Alan Boyle, "Kymeta and Intelsat Debut Kalo Satellite Service and Antennas at 'Coming-out Party,'" GeekWire (May 7, 2017) https://www.geekwire.com/2017/kymeta-intelsat-unveil-kalo-satellite-service-antennas/ (describing antennas designed to seamlessly switch from GSO to NGSO satellites)).

[6] Reply Comments of Telesat Canada, IB Docket No. 17-95, at 3-4 (filed Aug. 30, 2017); Reply Comments of Boeing, IB Docket No. 17-95, at 1-2 (filed Aug. 30, 2017).

consideration pending conclusion of a proceeding addressing NGSO licensing and operations.[7] Now that rules to facilitate NGSO-to-NGSO sharing are in place,[8] the time is ripe for the Commission to establish regulations for ESIMs operating with NGSO systems.

Doing so will confer numerous public interest benefits. Codifying a framework for NGSO ESIMs will drive increased investment in NGSO systems, promote harmonized use of spectrum across the globe, and spur efforts by manufacturers to design antennas capable of operating across multiple bands and communicating with a variety of satellite networks. As a result of these developments, U.S. consumers will have access to a greater variety of services that represent the most advanced technology, whether they are traveling domestically or abroad.

SES supports the specific rule changes the Commission has proposed for NGSO ESIM licensing and operation, with a few minor changes discussed herein. The Commission should authorize NGSO ESIM operations in all the band segments mentioned in the NPRM and should address NGSO ESIM use of the V-band as part of any future proceeding to adopt V-band FSS service rules. Blanket licensing of NGSO ESIMs is critical for regulatory parity with GSO satellites and is consistent with Commission policies. Authorizing ESIMs does not require any revisions to the NGSO sharing framework recently updated by the Commission. By adopting these measures, the Commission will usher in more robust, cutting-edge, and valuable uses of spectrum by NGSO systems ready, willing, and able to meet vibrant customer demand.

II. AUTHORIZING NGSO ESIMS WILL SERVE THE PUBLIC INTEREST

Expanding the existing regulatory framework for ESIMs to allow communications with NGSO satellites will enable the delivery of high-capacity, low-latency data services to mobile

[7] *See* NPRM at ¶ 4.
[8] *Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters,* Report and Order and Further Notice of Proposed Rulemaking, 32 FCC Rcd 7809 (2017) ("NGSO Order").

platforms to meet growing consumer demand and expectations. Enacting permanent rules for NGSO ESIMs, as opposed to permitting such operations by waiver, will provide much-needed certainty for NGSO ESIMs already operating in the United States and encourage entry by new providers. Commission action will also promote global spectrum harmonization, allowing customers to take advantage of seamless connectivity. Moreover, these benefits for users are possible with no adverse effect on other authorized communication services.

SES already has a successful track record operating Ka-band ESIMs communicating with the O3b MEO constellation in the U.S. Since 2014, O3b has been authorized by the Commission to use parts of the Ka-band to provide maritime service to U.S.-registered vessels and foreign-registered vessels in and near U.S. territorial waters.[9] Under this authority, SES has worked with its partners to provide high-capacity, low latency service to consumers on board cruise ships, transforming connectivity in the cruise industry.[10] SES has also provided enterprise-grade, low-latency connectivity to maritime platforms off the U.S. coast, enabling cloud computing for energy industry customers.[11]

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[9] *See* O3b Limited, IBFS File No. SES-LIC-20130528-00455, granted May 13, 2014; Letter to Joslyn Read, VP Regulatory Affairs, O3b Limited, 29 FCC Rcd 5057, DA 14-637 (IB/OET May 13, 2014); Letter to Suzanne Malloy, VP Regulatory Affairs, O3b Limited, DA 15-601 (IB/OET May 20, 2015); IBFS File No. SES-MSC-20151021-00760, granted Jan. 29, 2016.

[10] Gregory Martin VP Mobility, *Behind the Scenes: Royal Caribbean Cruise Lines - Fastest Internet at Sea*, SES (Feb 1, 2017), https://www.ses.com/blog/behind-scenes-royal-caribbean-cruise-lines-fastest-internet-sea; Martyn Wingrove, *Technology pushes cruise ship connectivity to record levels*, Passenger Ship Technology (Jan. 3, 2018) https://www.passengership.info/news/view,technology-pushes-cruise-ship-connectivity-to-record-levels_50333.htm.

[11] Tim Webb, *Enabling the Energy Industry with Fiber*, SES (Sept. 9, 2016), https://www.ses.com/blog/enabling-energy-industry-fiber. While the current O3b operations for off-shore platforms were authorized on a non-conforming basis, as opposed to as ESIMs, future off-shore deployments may be on mobile vessels that are classified as ESIMs.

Certainty for the NGSO ESIM market will foster the O3b network's continued growth and development and is critical to promoting and sustaining investment in other NGSO systems. Because of the global nature of NGSO satellite constellations, increased investment in NGSO systems resulting from ESIM demand will drive worldwide expansion of NGSO satellite capacity that can serve remote and rural areas and provide restoration if terrestrial networks are damaged due to natural disasters. For example, following Hurricane Maria, SES's NGSO capacity in place for maritime ESIM customers was used to restore mobile services in Puerto Rico after overwhelming hurricane damage to terrestrial communications infrastructure.[12]

Establishing rules for NGSO ESIMs in the U.S. will also unleash further innovation in the antenna design and manufacturing industry. Clear rules and technical standards for ESIMs designed to communicate with NGSO constellations will provide certainty for manufacturers developing antennas that can communicate across frequency bands and constellations. With multi-band, multi-orbit antennas, satellite operators can provide tailored connectivity solutions across frequency bands communicating with satellites in various orbits, all using one antenna.[13] The FCC's NGSO ESIM rules will ensure that these manufacturers can bring their antennas to the market quickly, enabling a faster return on their investment, in turn making the U.S. a desirable market in which to introduce innovative new equipment.

Commission rules will also further spectrum harmonization, enabling more cost-effective and valuable service offerings. The European Communications Commission ("ECC") has

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[12] *See* The Uniendo a Puerto Rico Fund and the Connect USVI Fund, *et al*., Comments of SES Americom, Inc and O3b Limited, WC Docket No. 18-143 *et al*., Jul. 26, 2018.

[13] *See, e.g.*, James Walsh, *Carnival Installs Multi-Orbit, Tri-Band Shipboard Antenna System of Intellian*. VIA SATELLITE (Mar. 15, 2018), https://www.satellitetoday.com/mobility/2018/03/15/carnival-installs-multi-orbit-tri-band-shipboard-antenna-system-of-intellian/.

already adopted a decision to facilitate the operation of Earth Stations on Mobile Platforms ("ESOMPs") with NGSO systems in Ka-band spectrum.[14] The ECC decision and the FCC's rules will provide a template for other jurisdictions to develop compatible frameworks, allowing U.S. entities, such as airlines and maritime operators, to seamlessly operate ESIMs across national borders.[15] Such harmonization will further spur antenna design developments, provide economies of scale for manufacturers, and drive more competitive pricing of ESIM services.

Moreover, experience demonstrates that NGSO ESIMs can operate compatibly with GSO networks. Pursuant to the ECC ESOMPs decision, ESIMs have operated with NGSO FSS satellite systems in the 17.3-20.2 GHz, 27.5-29.1 GHz and 29.5-30.0 GHz frequencies in Europe on vessels and vehicles without any reported incidents of interference, enabling an expanded market for high throughput connectivity on mobile platforms, including for the burgeoning cruise industry.[16]

Thus, by adopting rules for NGSO ESIMs, the Commission can build on the successful GSO ESIMs framework to add another facet to its regulatory regime for mobility services that will support advanced NGSO operations, benefit antenna manufacturers, and promote innovative, ubiquitous, and cost-effective options for U.S. customers.

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[14] ECC Decision (15)04 on the harmonised use, free circulation and exemption from individual licensing of Land and Maritime Earth Stations On Mobile Platforms (ESOMPs) operating with NGSO FSS satellite systems in the frequency ranges 17.3-20.2 GHz, 27.5-29.1 GHz and 29.5-30.0 GHz (adopted July 2015) ("ECC ESOMPs Decision").

[15] *See, e.g.*, Resolution 902 (WRC-03), Annex 1 ("[t]he administration that issues the licence for the use of ESVs in these bands (licensing administration) shall ensure that such stations follow the provisions of this Annex and thus do not present any potential to cause unacceptable interference to the services of other concerned administrations.").

[16] *Fastest Growing Cruise Market is the Med*, CRUISE INDUSTRY NEWS (Aug. 14, 2018), https://www.cruiseindustrynews.com/cruise-news/19079-fastest-growing-cruise-market-is-the-med.html.

III. THE COMMISSION SHOULD ADOPT ITS PROPOSED NGSO ESIM RULES WITH MINOR CHANGES

The Commission should expand the scope of its ESIMs rules to cover communications with NGSO systems as proposed in the NPRM. Permitting NGSO ESIMs across all available frequencies is critical to unlocking the full potential of the investments made in next-generation NGSO constellations, enabling low-latency, high speed data connectivity for consumers on the move. SES is serving ESIMs today with its existing Ka-band O3b NGSO system, and the Commission has granted SES market access for its planned O3b mPOWER constellation, which will include additional Ka-band frequencies and introduce V-band capacity.[17] The O3b mPOWER constellation will set the new benchmark for connectivity to ESIMs, including maritime customers already served by the current O3b system, as well as enabling high-capacity, low-latency inflight connectivity.[18] SES offers the following recommendations for each of the frequency ranges addressed in the NPRM.

11.7-12.2 GHz, 14.0-14.5 GHz, 18.3-18.6 GHz, 19.7-20.2 GHz, 28.35-28.6 GHz. and 29.5-30.0 GHz: The Commission should adopt its proposal to allow ESIMs to communicate with NGSO FSS systems on a primary basis in the 11.7-12.2 GHz (space-to-Earth); 14.0-14.5 GHz (Earth-to-space); 18.3-18.6 GHz (space-to-Earth); 19.7-20.2 GHz (space-to-Earth); 28.35-28.6 GHz (Earth-to-space); and 29.5-30.0 GHz (Earth-to-space) frequency bands.[19] In addition, the Commission should implement its proposal to add a paragraph (c) to footnote NG527A to indicate that ESIMs can operate with NGSO FSS space stations in these six

[17] *See* O3b Market Access Modification Grant.
[18] Mary Kirby, *SES sets its sights on meaningfully serving aero with MEO*, RUNWAY GIRL NETWORK (posted Sept. 27, 2017), https://runwaygirlnetwork.com/2017/09/27/ses-sets-its-sights-on-meaningfully-serving-aero-with-meo/ ("Kirby").
[19] NPRM at ¶ 9.

frequency bands,[20] but should align its proposed language for that subsection with Section 25.289, using the term "unacceptable interference" instead of "harmful interference."[21]

18.8-19.3 GHz and 28.6-29.1 GHz: The Commission should authorize ESIMs to communicate with NGSO FSS systems on a primary basis in the 18.8-19.3 GHz (space-to-Earth), and the 28.6-29.1 GHz (Earth-to-space) frequency bands as well.[22] As proposed in the NPRM, the Commission should add paragraph (e) to footnote NG527A to indicate that ESIMs can operate both with GSO FSS space stations and with NGSO FSS systems in these two frequency bands, provided that GSO FSS operations not cause harmful interference to, or claim protection from, NGSO FSS systems. This addition is consistent with Footnote NG165, which provides that GSO FSS operation shall not cause harmful interference to, or claim protection from, NGSO FSS systems.[23]

19.3-19.4 GHz, 19.6-19.7 GHz, and 17.8-18.3 GHz: The Commission should allow ESIMs to receive signals from NGSO FSS space stations on a secondary basis in the 17.8-18.3 GHz (space-to-Earth) frequency band and on a non-interference basis in the 19.3-19.4 GHz (space-to-Earth) and 19.6-19.7 GHz (space-to-Earth) frequency bands.[24] As the Commission suggests, NGSO ESIMs can indeed ensure protection of terrestrial operations with the appropriate power-flux density limits.[25]

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[20] *Id*.
[21] 47 C.F.R. § 25.289 ("Unless otherwise provided in this chapter, an NGSO system licensee must not cause *unacceptable interference* to, or claim protection from, a GSO FSS or GSO BSS network.") (emphasis added).
[22] NPRM at ¶ 10.
[23] 47 C.F.R. § 2.106, Footnote NG165.
[24] NPRM at ¶ 12.
[25] *Id*. at ¶¶ 11-13.

The Commission does not propose to include V-band spectrum in its NGSO ESIMs rules, and SES recognizes that it would be premature to do so at this time. However, SES encourages the Commission to consider NGSO ESIMs matters as part of any future proceeding developing service rules for V-band FSS. The Commission has already authorized O3b mPOWER and other NGSO systems to use the V-band[26] and appears to be preparing to launch a proceeding to consider service rules for FSS in V-band. Aeronautical applications are likely to be a focus for V-band NGSO constellations since atmospheric attenuation is reduced at flight altitudes. High-capacity broadband internet on airplanes is fast becoming a must have feature for consumers, including business passengers and families that need to stay connected.[27] The Commission should therefore address ESIM rules in parallel with its V-band FSS service rules to facilitate rapid market development of new types of antennas necessary to serve the rapidly growing and data-hungry aeronautical market.

To implement its proposals to include NGSO constellations in its rules governing ESIMs, the Commission should adopt the changes to Sections 25.115, 25.228, and 25.103 of its rules proposed in the NPRM. However, the Commission should modify its proposed Section 25.228 to retain a separate NGSO-specific self-monitoring and network control requirement for ESIMs to ensure they comply with their authorized EIRP density. The monitoring and network control requirements are consistent with the design of NGSO ESIM terminals and are necessary to ensure that such terminals operate consistent with their authorization. These modifications will

[26] *See*, *e.g.*, O3b Market Access Modification Grant.
[27] *See* Kirby ("In addition to serving cloud service providers; mobile networks, and civil & government markets, SES Networks CEO Steve Collar says mobility – specifically maritime (which O3b already supports with 12 MEO satellites, and a further eight to launch in 2018/19) and aero – are 'two parts of our industry where we have an absolute right to win and will continue to do so' with O3b mPOWER.").

ensure that the Commission's rules accurately reflect the Commission's decision to authorize ESIMs to communicate with NGSO systems and will align NGSO ESIM rules with the Commission's recently modified GSO ESIM rules, as applicable to NGSO systems.

In addition, the Commission should allow blanket licensing of ESIMs operating with NGSO FSS systems.[28] The Commission is correct that "[s]uch blanket licensing would further maximize efficient spectrum use for the increased provision of broadband access and additional flexibility for FSS systems in bands where blanket licensing is already available for earth stations operating at fixed locations."[29] The blanket licensing regime allows ESIM operators to apply for a single authorization for multiple, technically-identical antennas.[30] This flexibility lowers regulatory barriers to providing high-speed, low-latency internet connectivity to traveling consumers and businesses using ESIMs to connect remote locations to their corporate networks. However, the Commission should confirm that when it states that "ESIMs' communications with NGSO FSS systems would be limited to frequency bands in which NGSO FSS systems have a primary status, or *have been found to be able to operate on a secondary or non-conforming basis, without causing interference to primary users of those band*s," it is referring to the frequency bands to be authorized for NGSO ESIMs through this proceeding.[31] Such a confirmation would remove any concern that the Commission intends to require a separate compatibility showing for a given frequency band to be eligible for blanket licensing.

The Commission is correct to believe that "the operational characteristics of NGSO ESIMs do not necessitate additional requirements on ESIM communications with NGSO FSS

[28] *Id.* at ¶ 15.
[29] *Id.*
[30] *See* 47 C.F.R. §§ 25.221, 25.222, 25.226, 25.227, as modified by the GSO ESIMs Order.
[31] NPRM at ¶ 15 (emphasis added).

space stations beyond what we have considered here because such operations are already being conducted."[32] As the NPRM observes, SES is successfully providing high-capacity data services to ESVs using the O3b NGSO FSS constellation.[33] The Commission, however, seeks comment on "the level of complexity that communications with ESIMs would introduce to the coordination between multiple NGSO FSS constellations under the Commission's rules and the potential for in-line interference as compared to that associated with the coordination between NGSO FSS constellations if communications were limited to fixed earth stations."[34] SES believes that the Commission's NGSO sharing rules are sufficient to address any NGSO ESIM sharing scenarios involving inline interference events. The NGSO sharing rules incentivize operators to work in good faith to avoid inline interference but also provide a default sharing mechanism in the event a coordination agreement has not been reached.[35] The mobile nature of NGSO ESIM operations does not require a change to the Commission's NGSO sharing regime.

IV. CONCLUSION

The Commission should adopt its proposals to expand its ESIMs rules to include NGSO constellations with the modifications discussed above.

Respectfully submitted,

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[32] *Id.* at ¶ 22.
[33] *Id.*
[34] *Id.*
[35] NGSO Order at ¶¶ 48-50.

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